TITLE: NON-CORRELATION OF MUTAGENIC ACTIVITY WITH CONDENSATE OR NICOTINE LEVELS IN CIGARETTE SMOKE FROM FLUE-CURED TOBACCOS

AUTHORS: H. W. Spurr, Jr.*, R. Gwynn, and J. F. Chaplin

AFFILIATION: USDA-ARS, Oxford Tobacco Laboratory, Oxford, NC 27565

ABSTRACT: Mutagenic activity, condensate level and nicotine level were determined in cigarette smoke from 13 selected tobaccos. These included nine flue-cured cultivars, three Tobacco Introductions, and one low nicotine line. They represented a range in condensate and nicotine levels. All tobaccos were grown, harvested and cured as flue-cured tobacco at Oxford during 1980. Tobacco was stemmed and lamina made into 85 mm cigarettes which were selected and smoked to a 23 mm butt length on a Phipps and Bird Smoking Machine. Smoke was collected on Cambridge filter pads. Pads were extracted with isopropanol which was used in determinations of mutagenic activity, condensate and nicotine levels. Mutagenic activity was determined by the Ames Test (strain TA 1538 of the bacterium Salmonella typhimurium). Mutagenic activity ranged from 2500 to 9200 mutants/g, condensate from 16-32 mg/g and nicotine from 0.5 to 8 mg/g tobacco smoked. There was no correlation between mutagenic activity and condensate level or mutagenic activity and nicotine level. This indicates mutagenic activity in tobacco smoke condensate is determined more by the quality or character of the condensate than the total quantity of condensate or nicotine.

REVIEW: There were three objectives in this study. First an attempt was made to characterize CSCs (actually TPMs) by measuring mutagenicity in the Salmonella/microsome (S/M) test. Second, an effort was made to correlate mutagenic activity with TPM yield per cigarette and/or nicotine level per cigarette. Finally, the authors wished to determine if a tobacco breeding program could be established using the S/M test as a guide for which tobaccos would be most beneficial (less mutagenic) to cross with one another. This latter objective was not addressed in the presentation because of time limitations. To accomplish the first objective, cigarettes were made from each of the 13 tobacco types and 3 separate TPM collections were tested in 3 separate Salmonella agar overlay experiments in the presence of S9 (no reference to species, organ, inducer). (The presenter indicated that none of the TPMs were active without S9 due to the high degree of toxicity.) Slopes of the linear portion of the dose response curves at nontoxic levels (no dimunition of the background lawn or loss of histidine revertants) were used to define each TPM sample. The authors ranked each tobacco with respect to mutagenic activity (histidine revertants per gram of tobacco smoked), nicotine level per cigarette, and TPM yield per cigarette. They tried to determine if a significant correlation existed between any of those parameters (their second objective). They found only one -- the TPM level was significantly correlated with the nicotine level for each tobacco. In my opinion, none of these findings were surprising! The authors became excited when the rank order of the mutagenic activity of the various tobaccos appeared to be related to what these investigators thought each tobacco's in vivo activity should be. However, as soon as they altered their mutagenic activity calculation from revertants per gram of tobacco smoked to revertants per mg of TPM tested, this relationship no longer existed (as expected).

As with most papers, the question and answer session proved more revealing about the work done than the presentation itself. Dr. Hecht of the American Health Foundation (AHF) asked if a correlation was attempted between mutagenic activity and nitrate levels in the tobaccos tested. The answer was, "no." Dr. Hoffmann (also of AHF) queried Dr. Spurr about a correlation between mutagenic activity and the protein levels of the test tobaccos. Dr. Spurr replied that this was not attempted which prompted Dr. Hoffmann to state that it seemed as though Dr. Spurr was not looking for any correlations based on the parameters he examined. Another question concerned the shape of the dose response curves obtained in the Salmonella tests. The answer given by Dr. Spurr suggested that either he didn't understand the question or he didn't understand the S/M assay.

-Reviewed by R. McCuen